WORKING MEMORY AND COGNITIVE FLEXIBILITY AS PREDICTORS OF DIVERGENT THINKING AMONGST UNDERGRADUATE STUDENTS: AN INTERVENTION STUDY

A
Synopsis
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CONCEPTUAL FRAMEWORK

Working memory is the "*blend of various mental undertakings, which incorporate the capacity for mental practice and control of data*". Baddeley proposed a Multi Component Model of working memory incorporating a crucial leader regulator "central executive" alongside two strivers, the phonological loop and the visuospatial sketch pad. The role of central executive, is an administrative component that utilizes the frontal lobe accountable for activation and arranging the input with regard to working memory and long-term memory frameworks. Working Memory is persistently considered as the psychological workspace, where considerable data is reserved in an extremely dynamic state, open for other intellectual procedures (Baddeley and Hitch, 1974). It integrates procedures that encode, store and control data. Long-term memory with an enormous storage limit holds information in a structure, which is in contrast to working memory. The Working Memory model accounts for both capacity and control of data. The phonological loop comprised of two sections i.e. a phonological store as well as an articulatory control process that rely on internal discourse. This subsystem is accountable for the coding of discourse and apparently other sound data, though the visuospatial sketch cushion bases on visual data. This also has a connection with thinking, where the internal discourse enables the thinking to move to diverse dimensions. Working Memory is assumed to be involved when we are using our thoughts and skills to accomplish our tasks. Another variable that seems important during this phase is cognitive flexibility. While the working memory is functional it is important that the individual observes cognitive flexibility to consider all possible dimensions associated with the task at hand.

'Cognitive flexibility is the human ability to adapt to the cognitive processing strategies to face new and unexpected conditions in the environment' (Canas et al. 2003). It is important that Cognitive Flexibility could be acquired with experience. It also involves the adaptation of cognitive processing strategies, 'a sequence of operations, which search through a problem space' (Payne et al. 1993). Therefore, cognitive flexibility refers to changes in behaviors and not in discrete responses. Also, the adaptation occurs to new and unexpected environmental changes subsequently, when a person performs a task for some time.

Cognitive flexibility generally refers to our ability to adapt flexibly to our continually changing environment. Apparently, humans and animals are exceptionally good in this ability. Individuals can exist with behavioral strategies provided they seem optimal for goal achievement, yet they update the strategies flexibly when there is a need for sufficient change. Moreover, it is possible to enhance cognitive flexibility by practicing meditation, a consciousness-changing technique, reversal learning, art therapy etc. showing benefits on cognitive flexibility. This also has connection with thinking, where the internal discourse (thinking aloud) enables the thinking to move in diverse dimensions. Working Memory along with cognitive flexibility both are assumed to be helping thinking to some extent. It is evident that thinking along with cognitive flexibility and working memory will bring the loose ends of any information together. But whether there is a specific role played by these variables in the divergent thinking needs to be explored yet.

Additionally, divergent thinking directs to a method of addressing issues, wherein diversity of possible solutions is projected with an end goal, to determine the one solution that works in the most unique fashion. Divergent thinking materializes in a free-floating and unconstrained way, bringing about abundant potential provisions in a short while. Divergent thinking capacity is categorized as a “broad search for logical alternatives that outcomes in the creation of numerous plans to an open finished issue” (Guilford, 1975).

Divergent thinking involves understanding the problem from innumerable dimensions and creating different solutions. It isn't synonymous with innovative thinking, although it reflects the capacity to create thoughts and may assume a dominant role. This is possible only when the individual has cognitive flexibility and a prompt working memory. Since, it doesn't penalize youngsters for their absence of skill or efficiency, it holds a favorable position over other “accomplishment arranged evaluations” and is predominantly helpful with children as well as students. Even though actual products (e.g., publications, works of art) may be valuable records of imagination in specific examples of grown-ups, thoughts are furthermore helpful for investigation of regular creativity. Considering the pandemic situation faced by the students who expected a smooth transition from school life to college life with more exposure, suddenly they were expected to switch over to study online for long duration

under uncertain situations. This discussion here raises certain research questions: *about the possible and expected relationship of divergent thinking with working memory and cognitive flexibility, contribution of working memory and cognitive flexibility in determining divergent thinking, how far cognitive flexibility helps undergraduate students promote divergent thinking in their thought process? How far the intervention helps in bringing about cognitive flexibility in thinking? Whether there is any significant contribution of working memory and cognitive flexibility that is activated during the thinking task, in determining divergent thinking of the undergraduates who are in a transition phase? Is there any other view that might be explored?'*

Considering the interrelation and potential involvement of Working Memory and Cognitive Flexibility in thinking procedures, the conceptual framework of the study is exhibited in Figure 1.

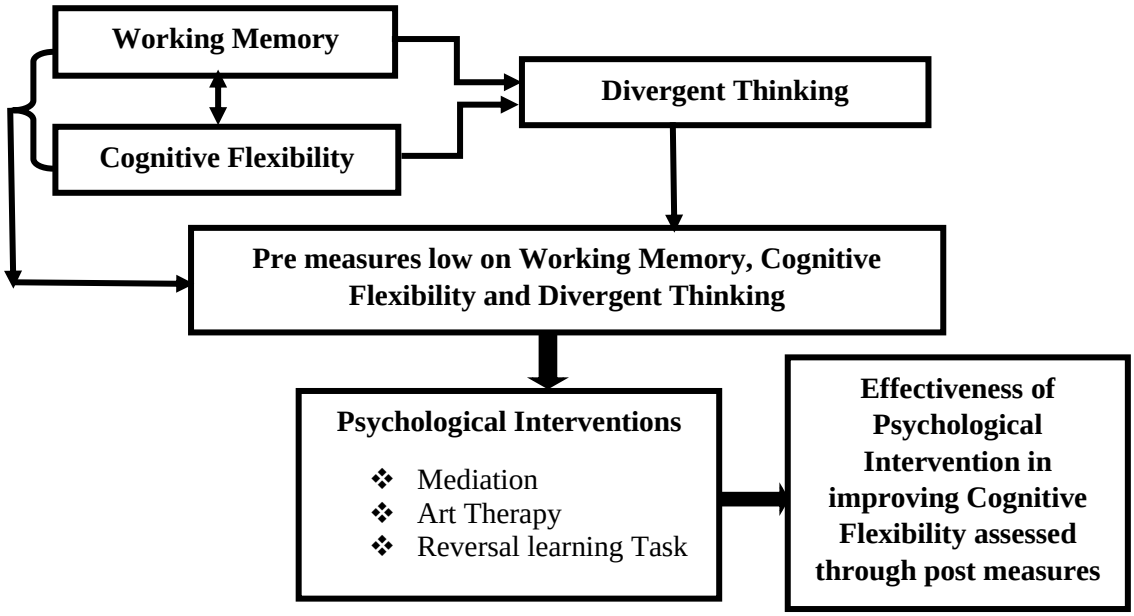
Working Memory
Cognitive Flexibility
Divergent Thinking
Pre measures low on Working Memory, Cognitive Flexibility and Divergent Thinking
Psychological Interventions
Mediation
Art Therapy
Reversal learning Task
Effectiveness of Psychological Intervention in improving Cognitive Flexibility assessed through post measures

Figure 1: Conceptual Framework of the study

According to the framework it is assumed that Working Memory and Cognitive Flexibility are interrelated with one another. Working Memory corresponds with Cognitive Flexibility in multiple ways. Working Memory and Cognitive Flexibility both are upgraded as the different thinking and reasoning patterns. Divergent thinking capabilities likewise may influence the Working Memory and Cognitive Flexibility. There are techniques that may improve cognitive flexibility, divergent thinking and may also influence working memory to some extent. To hypothesize it is always a good practice to explore the relevant related literature.

Here, related literature gives an overview of the various studies conducted so far with the variables under consideration. In view of the present study and the variables under consideration, some of the studies conducted earlier are as follows:

Table 1. Summary and Outcomes of reviewed related literature

S.No.	Names /Year	Variables	Results and Outcomes
1	Piau, Mahmoudzadeh, Kibleur, Polosan, David, and Wallois (2021)	Cortical hemodynamic mechanisms of reversal learning using high-resolution functional near-infrared spectroscopy	Functional hemispheric asymmetries between punishment and reward processing by fNIRS following reversal of a learned rule was observed. Moreover, the left dorsolateral prefrontal cortex and inferior frontal gyrus were activated under the reward condition only, whereas the orbito-frontal cortex was significantly activated under the punishment condition, with a tendency towards activation for the right cortical hemisphere. Results are compatible with the suggestion that the DLPFC is involved in the detection of contingency change. A new representation proposed for reward and punishment, with left lateralization for the reward process. Results provide insights into the indirect neural mechanisms of reversal learning and behavioral flexibility and confirm the use of fNIRS imaging in reversal learning tasks.
2	Akyol and Boyaci (2020)	Cognitive flexibility, positivity and career future.	Findings display positive and significant relationship between career future, cognitive flexibility, and positivity. Cognitive flexibility and positivity are significant predictors of career future of university students.
3	Junhong, Rawtaer, Goh, Kumar, and Mahendran (2020)	Art Therapy enhances Cognition and increases Cortical Thickness in Mild Cognitive Impairment	The role of MFG neuroplasticity in enhancing certain cognitive functions in Art Therapy is highlighted. AT is a neuroplastic intervention engender significant cognitive gains and associated cortical changes in the context of age-related cognitive decline, even as low-intensity intervention across 3 months. Significant gains in immediate memory and working memory span were detected in the Art Therapy group, relative to the control group. Relative to controls significantly increased Cortical Thickness in the Art Therapy group, was detected in a right middle frontal gyrus cluster. Furthermore, CT changes significantly

			and positively correlated with changes in immediate memory.
4	Esen, Özcan, and Sezgin (2017)	High School Students' Cognitive Flexibility, Self-Efficacy and Achievement	Cognitive flexibility obtained by general self-efficacy, academic self-efficacy, social self-efficacy, emotional self-efficacy and achievement were examined to show the facts that cognitive flexibility is predicted meaningfully in positive direction by predictor variables.
5	Hartkamp Mirjam, and Thornton (2017)	Meditation, Cognitive Flexibility and Well-Being	There were significant changes in cognitive performance, over and above practice-related improvements also shown by the control group. Retreat participants did, however, register positive improvements on the subjective measures.
6	Kercood, Lineweaver, and Colleen (2017)	Cognitive Flexibility, Academic Achievement and Career Choice of College Students with and without ADHD	Cognitive flexibility predicted mathematical and writing skills. Although students with different college majors did not vary significantly in their cognitive flexibility, the interaction between cognitive flexibility and ADHD shared a significant relationship with career choice confidence.
7	Izquierdo, Brigman, Radke, Rudebeck, and Holmes (2017)	Neural basis of reversal learning	Result give evidence that reversal learning generally test the ability to teach specific S-O associations, to estimate the likelihood that reversals can occur given accumulated evidence, and to generate a representation of option or task space. Availability of high resolution neuroscience techniques, it is possible to assign cell type- specific roles to each process to distinct aspects of cognitive flexibility
8	Morarua, Memmerta and Kamp (2016)	Motor creativity, roles of attention breadth and working memory in divergent task	Description of separate flexibility and persistence pathways affected differently by breadth of attention and working memory. Motor creativity tested using a divergent task found that a broad attention increased flexibility but not persistence. Originality was unaffected. Taxing working memory did not affect persistence, flexibility or originality. Results provide partial support for the dual-pathway model in motor creativity.
9	Sun, Chen, and Zhang (2016)	Brain Functional and Structural changes induced by Divergent Thinking Training	Behavioral results exposed that both the originality and fluency of divergent thinking are significantly improved by training. Functional changes induced by training were observed in the dorsal anterior cingulate cortex, dorsal lateral

			prefrontal cortex and posterior brain regions. The gray matter volume was significantly increased in the dorsal anterior cingulate cortex after divergent thinking training. Results propose that enhancement of creativity may rely not only on the posterior brain regions that are related to the cognitive processes of creativity.
10	Müller, Gerasimova, and Ritter (2016)	Concentrative Meditation influences Creativity by increasing Cognitive Flexibility	Experienced meditation practitioners performed a meditation session either mindfulness or concentrative meditation. Participants' creativity and cognitive flexibility were measured before and after the meditation session, demonstrating that meditation increases creative performance, irrespective of meditation style. Concentrative meditation significantly led to an increase in cognitive flexibility.
11	Furley and Memmert (2015)	Creativity and working memory capacity in sports, creative decision making amongst skilled performers	Results indicate that domain-general working memory capacity was not associated with creativity in a soccer-specific creativity task. Findings are not supporting the previously reported suggestion of a positive relationship between a domain general measure of working memory capacity and domain-specific creativity. Results suggest moderating role of the nature of the creativity task in the interaction between divergent thinking and working memory.
12	Wallace, and Russ (2015)	Pretend play, divergent thinking, and math achievement in girls	Results continued to be significant when verbal intelligence was controlled. Important longitudinal evidence provided for predictive power of pretend play in children's development and adaptive functioning, particularly relating to divergent thinking and math achievement in girls
13	Kamp, Admiraal, van and Rijlaarsdam (2014)	Enhancing divergent thinking in visual arts education, Explicit instruction of metacognition effects	Implications stating in the domain of visual arts, instructional support in building up meta-cognitive knowledge about divergent thinking may improve students' creative processes.
14	Jobidon, Bouak, and Cheung (2013)	Working memory training association with lower prefrontal cortex activation in divergent thinking task	Results indicated that a short regimen of Working Memory training is associated with lower prefrontal activation (marker of neural efficiency) in divergent thinking.

15	Pike, and Miami (2013)	Art Therapy Effects on Cognitive Performance Among Ethnically Diverse Older Adults	Cognitive training strategies served as a framework for the study's 10-week art therapy intervention protocol. It is indicated that art therapy treatment was associated with significantly improved cognitive performance. Findings also suggest that session duration and art therapy approach significantly correlated with improved cognitive performance.
16	Lewis and Lovatt (2013)	Breaking away from set patterns of thinking, Improvisation and divergent thinking	Verbal improvisation as act of spontaneously creating strings of new words, while avoiding pre-planned phrases. Divergent thinking assessed using the Alternative Uses Task before and after a treatment condition of either improvisation or control tasks. Results demonstrate that participating in verbal and music improvisation increases scores on a divergent thinking task, suggesting that improvisation may enable people to break away from set patterns of thinking
17	Colzato, Ozturk, and Hommel (2012)	Focused-Attention Meditation and Open-Monitoring Training on Convergent and Divergent Thinking.	Meditation and OM meditation exert explicit effect on creativity. OM meditation induces a control state promoting divergent thinking, Focused Attention meditation does not sustain convergent thinking, to suggest that the enhancement of positive mood induced by meditating has boosted the effect in the first case and counteracted in the second case.
18	Slayton, D'Archer, and Kaplan (2010)	Outcome of studies on the Efficacy of Art Therapy	Review results suggest and support the claim that art therapy is effective in treating a variety of symptoms, age groups and disorders. Studies were slected from 1999–2007 measuring outcomes of art therapy effectiveness across ages of clinical and nonclinical populations. While numerous studies blend art therapy with other modalities, the review is restricted to studies that separate art therapy as the specific intervention.
19	Moore, and Malinowski (2009)	Meditation, mindfulness and cognitive flexibility	Attentional performance and cognitive flexibility are positively related to meditation practice and levels of mindfulness as suggested in results. Meditators performed significantly better than non-meditators on all measures of attention. Besides self-reported mindfulness was higher in meditators than non-meditators and

			correlations with all attention measures were of moderate to high strength.
20	Katharine, Blackwell, Nicholas, and Munakata (2009)	Working memory strength predicts children's cognitive flexibility	Children who perseverate are slower to respond to such questions than children who successfully switch to new rules, even after controlling for age and processing speed. Switchers may have stronger working memory strength than perseverates, with stronger rule representations supporting both flexible switching and faster responses to questions. Otherwise, better inhibitory abilities may support switchers' faster responses by helping them to resolve conflict.
21	Borella, Carretti, and Beni (2008)	Working memory and inhibition across the adult life-span	Results indicate a linear relationship between working memory measures and age, autonomously of the nature of the task, and a quadratic relationship between the single inhibitory measures and age. Hierarchical regression analyses show that inhibition accounts for a significant, but modest, part of the age-related variance in working memory. Suggested that inhibition is not as crucial a contributor of age-related changes in the functional capacity of working memory across the adult life-span as previously thought.
22	Zhuo, Prescott, Murray, Zhang, Baxter, and Nicolle (2007)	Early discrimination reversal learning impairment and preserved spatial learning in mice	Findings revealed that working memory affected by age, with 6-month-old mice performing better than 14-month-old ones. Older mice were also significantly impaired on reversal learning and on the intra- and extra-dimensional shift in attentional set-shifting. A significant transgene effect was apparent in reversal learning, with Tg2576 mice requiring more trials to reach criterion at 6 months old. Data indicates effects of normal aging are most pronounced on putative frontal cortex-dependent tasks and that increasing load affects discrimination reversal learning.
23	Cools, Clark, Adrian, Owen, and Robbins (2002)	Neural Mechanisms of Probabilistic Reversal Learning using Event-Related fMRI	Findings presented the signal change in ventral fronto striatal circuit is associated with reversal learning and is uncontaminated by negative feedback. Data agree with findings in rodents and nonhuman primates of reversal learning deficits after damage to ventral frontostriatal circuit.
24	Reynolds, Nabors, and	Effectiveness of Art	Results show three types of study

	Quinlan (2000)	Therapy	designs produce very similar results regarding the positive effects of art therapy, but their conclusions seem very different. Clarification of study design differences lend insight into the perceived effectiveness of art therapy

Research gap and Rationale of the study with future research directions

The review of the related literature prominently focus on Cognitive flexibility, positivity and career future; High-resolution functional near-infrared spectroscopy; Art Therapy enhancing Cognition and increasing Cortical Thickness in Mild Cognitive Impairment; Self-Efficacy and Achievement; Reversal Learning using Event-Related Functional Magnetic Resonance Imaging; Well-Being, Motor creativity, roles of attention breadth and working memory in a divergent doing task; Brain Functional and Structural Changes, visual arts education, Art Therapy on Cognitive Performance among ethnically Diverse Older Adults; Focused-Attention and Open-Monitoring Training on Convergent and Divergent Thinking, mindfulness, preserved spatial learning. The studies indicated mixed results regarding the relationship of working memory, cognitive flexibility and divergent thinking. The level of contribution by these variables in determining divergent thinking also needs to be identified. Individually the techniques have been used for varied aspects but no study explains, which technique proves better or these may be combined for better results. This seems as a gap that directs the current research to explore further.

It is observed once the students exercise cognitive flexibility their divergent thinking becomes a lot easier. The undergraduate students have just entered their adult life style, where divergent thinking is an essential aspect for excellence, adjustment and survival. Students do a lot of divergent thinking because today the demand is that they think creatively. They are being paid for being creative in their ideas. Often people are unable to realize that they are sometimes not able to find the solution because there is a fault in their approach towards finding solution. Sometimes the solution is very simple, all they need is the change in the direction of thinking, which is possible only with cognitive flexibility that promotes the Working memory and thinking to be functional.

So, basically if the undergraduate students are supposed to think divergently then they need to have an optimum level of working memory also. If the working memory and cognitive flexibility are stronger

in the students probably, they are able to indulge conveniently in divergent thinking in a better way. When a student has higher level of cognitive flexibility and working memory, both enhance the divergent thinking, performance and creative thinking, consequently. This study is relevant to explore possibilities of contribution of both the predictor variables in determining divergent thinking amongst the undergraduate students. The students who have faced uncertainties and difficulty in pandemic situation, while studying and a lot of switching over in the mode of studying online and offline, definitely need to improve their cognitive flexibility along with divergent thinking and working memory, so that sudden changes do no hamper their mind set. For this psychological intervention including techniques like meditation, art therapy, and reversal learning task might proof to be beneficial. Meditation is related to concentration, whereas Art therapy is a technique with the idea that creative expression can be healing and important for mental well-being as art is a significant fragment of the therapeutic field used in treatment techniques. Individuals explore self-expression and find new ways to gain personal insight and develop new coping skills. Half an hour of meditation, creative activity reduce stress and has positive effect on mental health. Here, high level of creativity or artistic ability is not essential for the art therapy to be impactful. Reversal learning tasks practiced daily also promotes to think about various aspects with flexibility and divergently. The students who may not be equipped with this flexibility and thinking pattern definitely require some practice for enhancing these aspects in their cognitions. Also, it is relevant to say that individuals sometimes fail, mainly because they could not be flexible in their thought process, so got stuck with trying only one solution to their problem. Such situations may occur with students but in their formative as well as transition phase of life if they are made to practice techniques like meditation, reversal learning, art therapy etc. they may set themselves free from the reins of rigidity in their life. Moreover, an individual who is cognitively flexible will never fall prey to breaking down completely, as there is a greater acceptability for flexibility amongst people around. Therefore, the current research is relevant for providing insight and information related to the above-mentioned issues.

Research Method

The study will comprise of Part 'A' concentrating on the relationship of Working memory, Cognitive flexibility and Divergent thinking along with exploring the relative contribution of Working memory and Cognitive flexibility in determining Divergent thinking. The Part 'B' of the study will focus on bringing about improvement in the Working memory, Cognitive flexibility and Divergent thinking of undergraduate students through the psychological intervention (Meditation, Art Therapy and Reversal Learning task).

Part 'A'

Objectives:

1) To study the relationship of Working memory, Cognitive flexibility and Divergent thinking for undergraduate students.
2) To study the contribution of Working memory and Cognitive flexibility in determining divergent thinking amongst undergraduate students.

Hypotheses:

1) There would be a significant positive relationship in between Working memory, Cognitive flexibility and Divergent thinking for undergraduate students.
2) Working Memory and Cognitive Flexibility would be contributing positively in determining Divergent Thinking among undergraduate students.

Operational definition of the Terms used:

(1) Working Memory: Working Memory is the part of short-term memory, which has limited capacity to hold information temporarily

(2) Cognitive Flexibility: It is the human ability to adapt cognitive processing strategies to face new conditions in the environment.

(3) Divergent Thinking: is a cognitive process, which is related to creativity that leads to multiple solution of a single problem.

Variables:

Predictor variables: (1) Working Memory, (2) Cognitive Flexibility

Criterion variable: Divergent Thinking

Sample:

A stratified random sample from the target population for the present study will consist of 400 undergraduate students from various universities, colleges and institutes in and around Agra city Uttar Pradesh. Strata will be based on course, age, Type of institute, Departments, family type, status etc. The age range of the students will be 17 to 22 years. A multi stage sampling will be used. Data will be garneted from both rural and urban areas. Students irrespective of their gender, caste, creed, religion will be included in the sample. Students having any psychological problem as declared by the medical practitioner will not be considered in the sample.

Tools:

(A) Cognitive Flexibility Scale (CFS): developed by Martin and Rubin (1995) consists of 12 items and one dimension. The CFS is a 6-point Likert-type measuring tool, in which 1 stands for "strongly disagree" and 6 stands for "strongly agree". Each item on the questionnaire consists of a statement dealing with beliefs and feelings about behavior. The CFS was developed and standardized on a sample of student, and showed high internal consistency (α = .76-.77), good concurrent and construct validity with measures of interaction and communication flexibility and high test–retest reliability (r = .83) over two weeks.

(B)Wechsler Adult Intelligence Scale (WAIS) IV**:** developed by a psychologist Wechsler (1955). The current version WAIS-IV (2008) will be used. On the WAIS-IV, Working Memory is measured by the Working Memory Index or WMI. In the sub parts of Working Memory: Digit Span (Core) - Attention, concentration, mental control, Arithmetic (Core) - Concentration while manipulating mental mathematical problems, (Letter-Number Sequencing) - Attention, concentration, mental control will be used. Cronbach's alpha/split-

half reliability coefficients for subtests in the WAIS-IV range from .87 to .98. Concurrent validity of this scale is good.

(C) Divergent Thinking Test: The Alternative Uses Task designed by Guilford (1967) measuring the divergent thinking will be used. There are four categories: Ideation Fluency, Originality, Flexibility and Elaboration considered for the level of Divergent Thinking. Guilford's Alternative Uses Task examines asking to enlist as many possible uses for common house hold item (such as brick, a paperclip, a newspaper). To gain insight into the types of ideas generated by adults, the AUT has a valid procedure. The test will be adapted for the use in the current study. Test-retest reliability is 0.86 for adults. Construct validity is 0.72.

Research Design: Correlation research design will be used to analyse the data.

Statistical Analysis: Stepwise Regression Analysis will be done for quantitative data analysis and results.

Part 'B'

Objectives:

1) To study the effectiveness of Psychological Intervention (Meditation, Art Therapy, Reversal Learning Task) in improving Working Memory, Cognitive Flexibility and Divergent Thinking of the undergraduate students.
2) To compare the impact of individual techniques i.e. Meditation, Art Therapy, Reversal Learning Task in improving the Working Memory, Cognitive Flexibility and Divergent Thinking of the undergraduate students.
3) To study the effectiveness of Reversal Learning Task and Art Therapy in comparison to Meditation as the technique for enhancing Divergent Thinking.

Hypotheses:

1) The Psychological Intervention (Meditation, Art Therapy, and Reversal Learning Task) would be effective in improving Working Memory, Cognitive Flexibility and Divergent Thinking of the undergraduate students.

2) There would be a significant difference in the impact of individual techniques i.e. Meditation, Art Therapy, Reversal Learning Task in improving the Working Memory, Cognitive Flexibility and Divergent Thinking of the undergraduate students.
3) Reversal Learning Task and Art Therapy would be more effective than Meditation in enhancing Divergent Thinking amongst undergraduate students.

Variables:

Independent Variables: Psychological Intervention: (1) Mediation, (2) Art Therapy (3) Reversal Learning Task

Dependent variable: (1) Working Memory (2) Cognitive Flexibility (3) Divergent Thinking

Sample:

Out of the sample of 400 undergraduate students, those students who will be identified as having low Working Memory, less Cognitive Flexibility and Divergent Thinking, a purposive sample of approximately 20 willing students will be selected. This sample will be divided into four matched groups (Intelligence, age, gender, course etc) with 5 students in each group for giving psychological intervention (Meditation, Art Therapy and Reversal Learning Task). The scores of the Part 'A' of the study will be taken as pre measures for the Part 'B' of the study. The conditions for the Pre and Post measures will be kept the same. Students already involved in regular meditative practices will be excluded.

Operational definitions of the terms

Psychological Intervention: includes activities used to modify maladaptive patterns of behaviour, emotional state, thinking and performance, resulting from faulty learning and the suitable treatment comprises of the unlearning of these behaviour patterns and the learning of corrected ones as well as altering emotional states, thinking and performance through practice.

Techniques

(a) Meditation: - is a simple, natural, effortless and systematic procedure practiced for 10-20 minutes each day to regulate attention and concentration.

(b) Art Therapy: - Art therapy is the way to express own hidden feelings and cognitive functioning by means of activities (Collage making through newspapers).

(c) Reversal Learning Task: - reversal learning initiates the individual to first learn to make one discrimination and then learn to reverse his choice. Reversal learning tends to be difficult since there is negative transfer effect. Individuals can be trained for reversal learning tasks. The researcher will select the stimuli for the task herself and standardize it.

Methods and Procedures:

Meditation: Meditation is a set of techniques that intend to inspire a heightened state of awareness and focused attention. Here, the meditation will be dependent on a verbal meditative stimulus which is approximately 10 -20 minutes verbal instructions for deep relaxation and concentration. To begin meditating, a place where the subjects can sit comfortably and quietly will be identified. Then the researcher will give instructions "along the path to a sincere meditation, you will encounter many distractions that may discourage you to relax. When you learn to listen, you become accustomed to the sound and you rest within it. While you sit down and get settled and comfortable, make sure that there are no distractions. Then close your eyes and do nothing for a minute or so and allow your mind and body to relax." Then an audio will be played for giving directions to the thoughts and allow the individual's attention to travel naturally to a less active, quieter style of mental functioning. After completing the session, the students will resume their daily routine. This technique will be practiced daily for six weeks and gradually terminated.

Art Therapy: is based on the belief that the "creative process of art making is healing and life-enhancing." Art expression is supportive in overcoming emotional distress, improving cognitive flexibility, resolving conflicts, achieving insights, reducing problematic behaviors, thinking differently and increasing a sense of well-being. After establishing rapport with the subjects, they will be given an art task ie. Collage making and let the students work daily in the morning for 10-20 minutes for six weeks. No interruptions or asking questions will be done. The subjects will be observed in the process of making the collage. If they say that they cannot do it they will be encouraged to give it a try for at least another five minutes. The undergraduate student will be given a task of making collage from

newspapers as the activity under the broad umbrella of Art/ Creative Therapies. The subjects will be given feedback for their task.

Reversal Learning Task: In the reversal-learning task numerous consecutive trials are given. On each trial, subjects are presented with two abstract visual patterns. Trial-and-error feedback will be used, while subjects must discover which of the two patterns is correct. Feedback of correct response will be a green smiley face and for incorrect response will be a red sad face presented as soon as the subject has chosen one of the patterns. The task will be conducted daily for 10-20 minutes on the selected group of subjects.

Psychological intervention will be given in increasing the contributing factor divergent thinking. Scores on cognitive flexibility questionnaire obtained in part "A" of the study will be served as baseline or pre-measures for this part of the study. Six weeks intervention will be given to the subjects with low cognitive flexibility. Meditation, Art therapy and Reversal Learning task will be given in a properly designed way to three matched groups of subjects. The fourth group of subjects will be indulging in a combination of all three techniques. Meditation will be done daily for two weeks then Art Therapy for next two weeks and finally Reversal Learning task for two weeks, to make it a six-week intervention session. Thus, the intervention will be continued for six weeks. Then afterwards post measures of Working memory, Cognitive flexibility and Divergent thinking will be taken. The measurement conditions maintained during pre- measure will be in effect during post-measure also.

Research Design: Pre and Posttest design will be used to analyse the data for this part of the study.

Pre-Measures of Working Memory, Cognitive Flexibility and Divergent Thinking (N=20)	**Techniques (Four Matched Groups)**	**Post Measures of Working Memory, Cognitive Flexibility and Divergent Thinking (N=20)**
Low Working Memory Less Cognitive Flexibility Less Divergent Thinking	1-Meditation (n_1 =5) 2-Art Therapy (n_2 =5) 3-Reversal Learning Task (n_3 =5) 4-Combination of all therapies (n_4 =5)	Effectiveness of Psychological Intervention (individual technique) in enhancing Cognitive Flexibility assessed through post measures

Statistical Analysis: Wilcoxon Sign Rank test and Kruskal Wallis ANOVA will be used to analyse the data.

Implications of the study

The research study has implications for the students who have face the new normal due to the pandemic situations, restrictions, lockdown, where a highly social age group is confined to a limited space and interactions. The undergraduates are in a transition phase from a school environment, where everything is explained and instructions given, to the college and universities environment, where they learn to survive socially, emotionally and academically. Due to the restrictions they hardly got any exposure to these aspects and dimensions important for their life. The intervention techniques will equip the students to reinvent themselves and learn skills to make their thinking flexible and divergent. This is also important for the school management and teachers to learn about the significance of the intervention techniques and the benefits derived from them to help the students, who may not be considered as flexible in their thinking and adjusting to the new normal. Such students will require training and counselling sessions and the current study would be a reference point for the counsellors to understand which particular technique will have more benefits and need to be considered. The outcomes of this study will have implications for future research and explorations also.

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